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the p/qth part, $=\frac{7}{12}$ part, of the ship, A buys of B at the same price C bought from both, the $\left[\frac{p}{q}-\frac{a}{b}\left(1-\frac{m}{n}\right)\right]$th part, $=\frac{4}{24}$ part, of the ship, for $\left(\frac{n}{m}\right)\left[\frac{p}{q}-\frac{a}{b}\left(1-\frac{m}{n}\right)\right]$ of \$$P$, $=$\$20000. As the condition of affairs now is, A *retains* the p/qth part, $=\frac{7}{12}$ part, of the ship; and, consequently, B *retains* the $\left[\frac{c}{d}-\left\{\frac{mc}{nd}+\left[\frac{p}{q}-\frac{a}{b}\left(1-\frac{m}{n}\right)\right]\right\}\right]$th part, $=\left[\left(1-\frac{m}{n}\right)\left(\frac{a}{b}+\frac{c}{d}\right)-\frac{p}{q}\right]$th part, $=r/s$th part, $=\frac{1}{12}$ part, of the ship. Hence A's share of the purchase-money received from C is

$$A=\left\{\frac{a}{b}-\left(\frac{n}{m}\right)\left[\frac{p}{q}-\frac{a}{b}\left(1-\frac{m}{n}\right)\right]\right\}\text{ of }\$P,$$

$$=\left[\frac{n}{m}\left(\frac{a}{b}-\frac{p}{q}\right)\right]\text{ of }\$P,=\$5000;$$

and for B's share of the purchase-money received, we have

$$B=\left\{\frac{c}{d}+\left(\frac{n}{m}\right)\left[\frac{p}{q}-\frac{a}{b}\left(1-\frac{m}{n}\right)\right]\right\}\text{ of }\$P$$

$$=\left[\frac{c}{d}+\frac{np}{mq}-\frac{a}{b}\left(\frac{n}{m}-1\right)\right]\text{of }\$P,=\$35000.$$

Note.—By making $p/q=r/s=\frac{1}{2}$, the numerical values of A and B will change places—see *Packard's Commercial Arithmetic*, p. 260, Prob. 30.

II. Solution by FRANK HORN, Columbia, Missouri, and J. M. LOWELL, Philadelphia, Pennsylvania.

II.
1. $\frac{1}{24}=\frac{5}{8}-\frac{7}{12}=$part of ship which A sold.
2. $\frac{7}{24}=\frac{3}{8}-\frac{1}{12}=$part of ship which B sold.
3. $\frac{8}{24}=\frac{1}{24}+\frac{7}{24}=$part of ship which was sold.
4. \$40000=amount received for $\frac{8}{24}$ of the ship.
5. ∴ \$5000=amount received for $\frac{1}{24}$ of the ship,
6. and \$35000=7×\$5000=amount received for $\frac{7}{24}$ of the ship.

III. ∴ for $\frac{1}{24}$ of the ship, which A sold he received \$5000, and for $\frac{7}{24}$, which B sold he received \$35000.

Excellent solutions received from *P. S. BERG*, *G. B. M. ZERR*, and *J. H. DRUMMOND*.

PROBLEMS.

29. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

A wine-merchant's *apparent* profit is 25% of his sales which are 10% of costless water. What is his *actual* rate per cent. of profit?

30. A chain 100m long, weighing 14 oz. to the foot, is suspended from points on a level 80m apart. What is the sag, the batter at the ends, and the horizontal tension? [*From Wentworth & Hill's High School Arithmetic.*]

31. Proposed by B. F. FINKEL, Professor of Mathematics in Kidder Institute, Kidder, Missouri.

Between Sing-Sing and Tarry-Town, I met my worthy friend, John Brown,
And seven daughters, riding nags, and every one had seven bags;

In every bag were thirty cats, and every cat had forty rats,
Besides a brood of fifty kittens. All *but* the nags were wearing mittens!
Mittens, kittens—cats, rats—bags, nags—Browns,
How many were met between the towns?

[*From Muttoon's Common Arithmetic.*]

Solutions to these problems should be received on or before December 1st.

ALGEBRA.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

SOLUTIONS TO PROBLEMS.

15. Proposed by SETH PRATT, C. E., Assyria, Michigan.

From a point in an equilateral triangle, the distances to the angles are, respectively, 20, 28, and 31 rods. Required a side of the triangle.

II. Solution by G. B. M. ZERR, A. M., Principal of Schools, Staunton, Virginia.

Let the $\angle ACO=\phi$, and $\angle BCO=\theta$. Then, $28^2=31^2+x^2-62x\cos\theta$.

$\therefore \cos\theta=\dfrac{177+x^2}{62x}$.....(1) $20^2=31^2+x^2-62x$ $\cos\phi$. $\therefore \cos\phi=\dfrac{561+x^2}{62\phi}$....(2) also

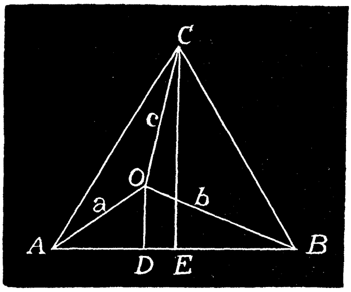
$\cos(\theta+\phi)=\cos\theta\cos\phi-\sin\theta\sin\phi$
$=\cos 60^\circ=\frac{1}{2}$.

$\therefore \cos\theta\cos\phi-\sqrt{1-\cos^2\theta}\sqrt{1-\cos^2\phi}=\frac{1}{2}$.

$\therefore \cos^2\theta-\cos\theta\cos\phi+\cos^2\phi=\frac{3}{4}$....(3).

(1) and (2) in (3) gives after reducing $x^4-2145x^2=-246753$.

$\therefore x^2=2023.02785$ or 121.97215.



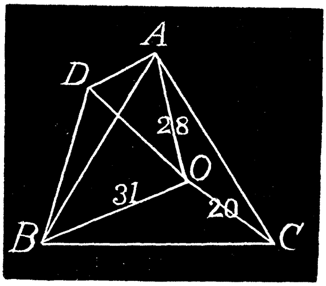
$\therefore x=44.97+$ or 11.045 according as the point is within or without the triangle.

III. Solution by J. K. ELLWOOD, A. M., Principal of Colfax School, Pittsburg, Pennsylvania.

Let ABC be the equilateral triangle, O the point within, $OC=20$, $OB=31$, $OA=28$. On OB construct the equilateral triangle OBD, and join AD.

In $\triangle$s ABD and OBC we have two sides and included angle of one equal to the same in the other. $\therefore AD=OC$.

In $\triangle\ AOD$ the three sides are now given, to find $\angle AOD$. Hence, $\cos AOD=\dfrac{31^2+28^2-20^2}{2\times31\times28}$ $=.77494=\cos 39^\circ\ 12'$.



The $\angle AOB=60^\circ+39^\circ\ 12'$. From the two